Fermilab — Fermi National Accelerator Laboratory

Technical Division-Machine Shop

Procedure Qualification Record — No. Fermi PQR Ti-5

Date: 2/20/2009

Revision: 1 Date: 1/08/09 Remarks: Revised to correct clerical errors

Welding Process/Weld Type: *GTAW/Automatic*
GTAW/Manual

Supporting WPS: ***Fermi WPS Ti-5 & Fermi WPS Ti-6***

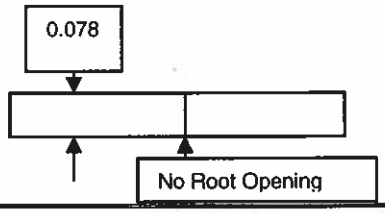
Joints (QW-402)

Weld Type: *Single V Groove Weld*
Backing: *Open Butt, Gas Backing Only*
Root Opening: *0.0"*
Root Face: *0.078"*

GTAW/Manual tack welds prior to automatic weld
Eight ¼" tacks every 45°

Details:

0.078 Wall x 3" diameter
AMI Orbital Machine Model 227-STD1.9



Base Metals (QW-403)
Material Spec., Type or Grade
SB-861, Grade 2 to *SB-861, Grade 2*
P-No. *51* to **P-No.** *51*
Thickness of Coupon (in.) *0.078 inches*
Diameter of Test Coupon (in.) *3 inches*

Post Weld Heat Treatment (QW-407)
Type: *No PWHT performed*
Temperature: *None*
Time: *None*

Filler Metals (QW-404) *None, Autogenous*
SFA Specification/ AWS Classification
Filler Metal F/ Analysis A-No
Size of Filler Metal (in.):
Weld Deposit "t"(in.):
Filler Metal Product Form:

Gas (QW-408) **Percent Composition**

	Gas	Mixture%	Flow Rate
Shielding:	*Argon*	*>99.995%*	*@ 30 CFH*
Trailing:		*None*	
Backing:	*Argon*	*>99.995%*	*@ 7 CFH*

Other: *Closed chamber weld head*

Positions (QW-405)
Position of Joint: *5G*
Weld progression: *Upward*

Preheat (QW-406)
Preheat Temperature: *32° F Minimum*
Ambient Temperature:
Interpass Temperature: *350° F Maxium*

Electrical Characteristics (QW-409)
Current/Polarity: *DCEN Pulsed Current*
Amps/Volts: *See Chart/Volts 10-15*
Tungsten Type : *1/16 diameter, EWCe-2 Pre-ground, shaped, and sized by manufacturer. Part # TC06-1085-03*

Travel (ipm): *As Required* **Oscillation:** *None*
String/Weave Bead: *Stringer*
Multiple/Single Pass (per side) *Multiple one side*
Multiple/Single Electrode: *Single Electrode*

Sequence Chart

Weld Levels	Pulse	Rotation	RPM Primary IPM	RPM Back IPM	Time	AMPS Primary	AMPS Back	PULSE Primary Per sec	PULSE Back Per sec	Other
1	ON	Continuous	0.42	---	5	103	50	0.30	0.30	Use TC06-1085-03 EWCe-2 pre-ground tungsten. Tack welds must be fabricated by GTAW/Manual qualified welder
2	ON	Continuous	0.42	---	50	103	50	0.30	0.30	
3	ON	Continuous	0.42	---	46	102	50	0.30	0.30	
4	ON	Continuous	0.42	---	21	102	50	0.30	0.30	
5	ON	Continuous	0.42	---	25	102	50	0.30	0.30	
6	ON	Continuous	0.42	---	30	102	50	0.30	0.30	

Prepared by Roger Hiller

Fermilab ***Fermi National Accelerator Laboratory***

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Procedure Qualification Record	**No.** ***Fermi PQR Ti-5***	Date	*2/20/2009*
Welding Process/Weld Type: *GTAW/Manual*	**WPS No.** *Fermi WPS Ti-5*		

Tensile Test (QW-150)

Specimen No.	Width (in.)	Thickness (in.)	Area (Squared in.)	Ultimate Total Load (lbs.)	Ultimate Stress (PSI)	Failure Type & Location
1	*.500*	*.075*	*.0375*	*2,118*	*56,480*	*Ductile/WM*
2	*.503*	*.075*	*.0377*	*2,165*	*57,389*	*Ductile/WM*

Guided Bend Test (QW-160)

Figure Number & Type	Result	Figure Number Type	Result
QW-462.3 (a) Face Bend	***Acceptable***	QW-462.3 (a) Root Bend	***Acceptable***
QW-462.3 (a) Face Bend	***Acceptable***	QW-462.3 (a) Root Bend	***Acceptable***

Visual Examination: *Acceptable*	**Radiograph per ASME Section IX, QW-191.2.2**

Welder's Name: *Michael P. Reynolds* **ID #** *03993N* **Weld Stamp #** *9*

Welding of coupon witnessed by: *Roger Hiller FNAL #00362N*

Tests Conducted by: *Bodycote Testing Group* **Test ID#:** *0302-019/01*

We Certify that the statements in this record are correct and that the test welds were prepared, welded, and tested in accordance with the requirements of Section IX of the ASME Code.

PQR prepared by: ***Fermi National Accelerator Laboratory***

Authorized Representative  ID# ***00362N***